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"Remotely Piloted Vehicles – Tracking High Value Individuals with Conventional Forces"

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Disclaimer

Abstract

The evolution of Overseas Contingency Operations has resulted in significant changes in Intelligence Surveillance, and Reconnaissance operations and requirements. Conventional Forces are targeting High Value Individuals, a mission that historically has been conducted by Special Operations Forces. Remotely Piloted Vehicles (RPVs) are critical to providing the intelligence required for these operations. The solution, however, is not simply increasing the number of RPVs available but employing the right mixture of assets and sensors. Developing a variety of sensor packages on RPVs and expanding intelligence training could significantly increase RPV effectiveness and provide conventional force commanders with the ability to conduct effective HVI targeting.

This research paper first analyzes the current capabilities and usage of RPVs by both Conventional Forces and Special Operations Forces. Second, this paper proposes technical and training recommendations to improve current RPV collection capability and provide Conventional Forces with the ability to target High Value Individuals effectively.

The research for the paper is composed of surveys and interviews of Special Operations Forces and Conventional Forces officers, technical documents and personal experience of the author in Operation Iraq Freedom and Operation Enduring Freedom.

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Background

The progress of Overseas Contingency Operations (OCO) has changed the nature of Intelligence Surveillance and Reconnaissance (ISR) Operations. Tactical Remotely Piloted Vehicles (RPVs) bring significantly improved intelligence capability to increasingly lower echelons of combat forces. RPVs have grown exponentially in quantity since the onset of Operation Iraqi Freedom in 2003 when Divisions controlled the RQ-7 Shadow, a small full motion video (FMV) RPV , which is now a Brigade Combat Team (BCT) asset. The high demand for these FMV assets has brought RPVs down to the infantry company level with the RQ-11 Raven. Although a marginally capable platform, it has provided company commanders with organic intelligence capability. FMV is now the standard and most widely employed sensor package by RPVs. Few sources of intelligence appeal to a ground force commander more than a current picture of the battlefield.

The increased availability of assets has changed how the United States Military fights counterinsurgency campaigns. ISR is no longer simply about the commander searching for the enemy's formations or monitoring for indications and warnings. The goal of ISR now is to find and fix targeted individuals across the battlespace. As the demands of counterinsurgency operations and the OCO increase, the demands on quantity and quality of RPVs also increases. Targeting high value individuals (HVIs) is no longer the purview of special operations. Conventional force commanders must also have this capability available to provide the intelligence needed to execute HVI targeting. RPVs represent a significant portion of this intelligence capacity. The solution, however, is not simply increasing the number of assets available but employing the right mixture of assets and sensors. Developing a variety of sensor packages on RPVs and expanding intelligence training could significantly increase RPV

effectiveness and provide conventional force commanders with the ability to conduct effective HVI targeting.

The following vignette describes a typical collection scenario for a Special Operations Task Force (SOTF). While it highlights the capabilities of RPVs it also highlights some of the limitations of the collection platform. The staff that planned the ISR operations depicted had no more training in collection than any other task force in the military.

Vignette

In late summer of 2007 the Iraq war was just coming down from its peak of violence. Al Qaida in Iraq was struggling to reorganize following the loss of their bloody leader, Abu Musab al Zarqawi. The cities were becoming untenable for them as the popular support was shifting to Iraqi National Forces and the coalition. Al Qaida leadership was shifting their base of operations into rural areas using couriers to move messages and propaganda into and out of the cities. Through interrogation, coalition forces located one of the link-up points for the couriers. The intelligence officer, S2, of a Special Operations Task Forces conducted a map reconnaissance of the area and shifted Intelligence, Surveillance, and Reconnaissance (ISR) assets to locate the facility.

The Predator RPV operator rapidly located the facility late in the evening using Infra-red (IR) sensors and detected activity at the location. Nearing eighteen hours of flight, the platform could no longer stay on station and had to return to base (RTB). However, the sensor operator noticed a suspect vehicle at the location and the Processing, Exploitation, and Dissemination (PED) cell processed the IR full motion video (FMV) feed and sent images of the facility and vehicle to the S2. Several days later, another Predator tasked by the S2 found activity at the same location and

was able to follow a vehicle from late evening until afternoon. The red sedan departed the original location and went to another link up point where the occupants conducted a meeting with personnel at the site.

Another Predator took over following the suspect vehicle through a series of meeting until late evening where its occupants conducted another meeting in the desert. Due to lighting conditions, the sensor operator had to switch from Electro-Optical (EO) camera to IR. Despite the close monitoring by the sensor operator and others, the S2 could not be certain they were still following the same vehicle. Again, the PED cell produced a large packet of link up points, meetings, and alternate vehicles for development.

Using other intelligence disciplines and sensors, the S2 was able to develop tracks for the vehicles and connect then with the original location. The following day, one of the suspect vehicles was followed as it repeated its movement throughout the area. At one point, the driver got out of the suspect vehicle and appeared to point at the Predator. He did not appear to change his actions.

That evening a series of targets based on the ISR collection was planned and prioritized by the S3 and S2. Identification of the targets were not completely known, but through interrogation and the cultural sense of the operations center personnel watching the FMV, the leaders were identified and targets were prioritized. Unexpectedly, just prior to time on target, the Predator watching the primary target unexpectedly was forced to RTB. The S2 shifted an ISR asset from another task force and covered the gap made with a United States Navy S3 orbiting near the battlespace and picked up the feed via Remotely Operated Video Enhanced Receiver (ROVER).

The result was eight enemy killed, two detained and several follow-on missions based on the intelligence gain.

Introduction

As the OCO continues to expand, the call for additional ISR platforms continues to grow as well. From 2003 – 2004, the Corps/ Combined Joint Task Force (CJTF) relied on only two RPVs to meets all their FMV requirements. Today, the Corps counts on at least twelve FMV systems in addition to each BCT possessing organic FMV support.[1] While having more assets is typically an improvement, the capabilities of the assets must also be considered. The above scenario highlights many of the issues confronting an intelligence officer in the OCO today. The primary issue is no longer the quantity of assets but rather how to best employ the proper mix of assets and sensors.

The vignette above demonstrates how well ISR can work in targeting HVIs in an OCO environment. The notional task force had sufficient assets, with the right sensor packages, to track the target until near execution. When lapse in coverage occurred, the S2 was able to rapidly cue another available asset to fill the gap. The ability to quickly shift assets was due largely to the focus the Task Force S2 was able to give intelligence collection.

The ISR focus of the Task Force was achieved through consistent close coordination between the S2 and Operations Officer, S3. The two officers would formally meet to discuss intelligence collection and potential operations for the next 24 – 48 hours. This ensured operations and intelligence were properly synchronized to fully support the commander's intent. The collections plans from this meeting were disseminated via Secure Internet Protocol Router Network (SIPRNet) and by voice to subordinate and higher Task Forces. This ensured each echelon

understood the intent of the collection plan. As a result, assets were allocated to targets according to the priority of effort; there was no allocation of assets based on standard package of ISR given to each Task Force.[2]

Due to the intense focus of the operations officer, the ISR missions were executed with the same careful oversight and planning as any kinetic operation. The day battle staff, ISR operators, and ISR watch ensured the assets were kept on task. Any shift in priorities or loss of an asset required immediate notification to the S2 and S3. Without this fused intelligence and operational ISR focus, planning and the PED cell, the targets would likely have never been executed to the degree of success they achieved.

The vignette, however, is for a Special Operations Task Force. The changing nature of the OCO often requires Special Operations Forces (SOF) to conduct missions outside of the OIF and OEF theater of operations. As a result conventional forces are now conducting traditional SOF missions. In addition to "traditional" counterinsurgency missions such as protecting the population and presence patrols, conventional Army units are conducting more missions targeting HVIs. Conventional Forces must be fully prepared to conduct not only the conventional target set but also HVI operations when SOF is not present for an extended period of time. There is some concern that an overemphasis in developing skills and sensors for HVI targeting may be effective for the current conflict, but not future conflicts. This is not the case with ISR technology and intelligence training. The ISR skills and technology developed for conventional forces to effectively target in the OCO directly translates into conventional warfare and potential future conflicts. A variety of RPV sensor packages and improved collection planning and intelligence analysis will aid in future hybrid warfare as well as the current conflict.

RPVs are a critical component in tracking HVIs and conventional operations. However, the current FMV only sensor packages limit the effectiveness of RPVs. One commander recently claimed he still had a 70% gap in information needs for Afghanistan.[3] While RPVs will likely never meet all the information needs, a variety of sensor packages and training could significantly increase their effectiveness. RPV sensors must provide the ability to locate and target HVIs for commanders down to the BCTs in a variety of environments.

Why RPV?

In addition to eliminating the risk to pilots, RPVs offer distinct advantages over previous ISR platforms. With their smaller size and engines, their acoustic signature is nearly masked by ambient noise in urban environments and they can fly at high enough altitudes in rural environments to avoid visual and audio detection. RPVs also have longer on-station times than manned aircraft. Predators can typically remain on station for up to sixteen hours and Shadows are able to maintain twenty-four hour coverage by transitioning airframes over several days. These two characteristics are critical, particularly during the initial phases of target development. Constant, undetected pattern of life development not only aids in the initial targeting of HVIs, but also in developing an understanding of their networks; a target that suspects they are under observation will alter their routine to avoid being targeted and to protect their network. Finally, RPVs offer unique advantages to commanders by removing another person from the communication path to the sensor. With manned platforms, ground force commanders communicate their intent to the Air Liaison Officer (ALO), who then communicates with the payload operator in the aircraft. With several RPVs, ALOs are not required to communicate with for ISR and, as a result, are able to focus on fire support. A ground force commander, with the

option to communicate directly with sensor operators, mitigates potential misunderstanding from the communication loop.

ISR operations with RPVs, however, are not flawless. Some of their distinct advantage also proves to be their greatest disadvantage. The size of the aircraft, while reducing its signature, also reduces the sensor payload. Some RPV systems are simply not physically capable of carrying more than one sensor. Secondly, the size of the RPV engine significantly limits its airspeed. Although able to rapidly shift between priority targets, their transit time is often twice that of a manned platform.[4] Use of RPVs must be planned well in advance. The inherent flexibility of the platform is enhanced with careful collection planning and coordination at all levels.

Current Usage

RPV operations at the BCT level and below fall into three categories; pattern of Life (POL) analysis, overwatch and battlespace awareness (BA).[5] These operations are explained below.

> **POL** – ISR is used to determine day-to-day activities of HVIs in order to develop triggers, follow-on operations, or other persons of interest. POL operations are personality dependent and not necessarily tied to geography. There are two types of POL operations: static and dynamic.
>
> Static POL operations are typically at a fixed location such as a business or residence where the HVI is located. During periods of limited activity, one ISR asset may be sufficient cover the target. However, as activity at the location increases, more ISR assets may be required to determine other POL at related locations.

Dynamic POL operations have more variables than static operations and are more asset intensive. Once a target begins to move, multiple ISR assets are required in order to first determine that the correct individual is being followed and, second, to identify persons and locations with which the target interacts. Dynamic POL operations may involve both vehicular and pedestrian movement. Dynamic POL operations are particularly rewarding because they can help determine the hierarchical order of networks (i.e. messengers moving between locations, deference shown between individuals). Vehicle follows during POL operations are central to understanding networks and the interaction between nodes.[6]

Recent experiences in Iraq by SOTFs and conventional Task Forces demonstrates the wide variance in utilization and prioritization in pattern of life analysis. While the experience reflects the priority of effort within the units, it also reflects minimal HVI targeting completed outside of SOTF. See appendix 1 for RPV usage questionnaire that provides more depth of SOTF and conventional TF experience:

> "Pattern of Life Analysis (persistent eyes on objective or individual target) was 75% of our ISR" (SOTF J2)

> "In the past 7 months we have employed RPVs to observe patterns of life analysis 4 different times, approximately 20 hours. Each time the asset was generally focused on a specific location or target based on HUMINT

> received from reliable vetted source reports and spot report." (Conventional Task Force Executive Officer)
>
> POL was conducted "Very infrequently – We generally focus on specific locations or targets if we receive reliable vetted source reports, spot reports, or tactical report." (Conventional Task Force Operations Officer)

Overwatch – ISR operations are used to observe friendly movements to or from a target, while on patrol or to identify potential enemy locations. Overwatch ISR operations are geographic, not personality dependent.

During friendly movement, ISR Overwatch operations are used in route clearance to determine locations of potential threats and possible improvised explosive devices (IEDs). Identification and location of threats is based on historic information, HUMINT reporting, and templated locations based on historical analysis.

When friendly units are executing objectives, ISR Overwatch operations assist to establish security and during actions on an objective. RPVs are particularly useful when the targeted individuals attempt to run, or "squirt," from the objective.

Overwatch provided by RPV likewise reflected the inverse in priorities between SOTF and Conventional Task Forces. Again this reflects the divergence in priorities between units:

> "RPV ISR is used to support convoy escort, route clearance patrol operations, and cordon and search / clearance operations for an average

> 50 hours of the 60 hour per week." (Conventional Task Force Executive Officer)
>
> "Most often, our RPV ISR is used to support convoy escort, route clearance patrol operations, or cordon and search / clearance operations." (Conventional Task Force Operations Officer)
>
> "25% of our RPV ISR was actions on the objective" (JSOTF J2)

BA – Battlespace Awareness operations are the most general-purpose use of ISR RPVs. BA operations can be route clearance ahead of friendly movements, identification of potential threat locations, and verification of reporting by sources and indigenous forces.

RPV time allocated for BA was infrequent. SOTF reported conducting none with Conventional Task Forces indicating very few hours devoted to BA. Employing RPVs with only FMV for wide area collection is simply not feasible.

> "In the past 7 months we have employed RPVs to gain general situation awareness; each hour is specifically tasked to scan." (Conventional Task Force Executive Officer, Iraq)
>
> Usage of RPV for BA was infrequent – We sometimes use the RPVs to try to confirm reports of explosions, fires, or other incidents that Iraqi

> Security Forces have reported but have not been confirmed by United States Forces." (Conventional Task Force Operations Officer)

Future Usage

Despite entering the final phases of OIF, OCO continue to expand geographically along with the requirements for both SOF and conventional forces. While both forces are finite, SOF is usually more limited and, subsequently, and has a more narrow mission focus across a wider theater of operations. SOF missions are typically focus on the recovery of personal and equipment or the targeting HVIs. SOF has a small footprint, and is ideal for low visibility operations or initial entry into a denied area of operations. However, with OCO, conventional forces are often already in place and familiar with the area of operations. Increased collection and analytic capabilities would fully prepare them to conduct operations targeting HVIs.

As OCO have evolved into greater precision in targeting, essentially man hunting, so have ISR collection priorities and capabilities. ISR capabilities have continued to be refined from large conventional formations to tracking individuals in rural or urban environments. Commanders and intelligence officers are no longer satisfied with the macro view of the environment; the micro view of the battle space has become the standard for effective targeting. The requirements for a detailed view of the target environment are a significant change not only in assets and capabilities, but also in how operations centers track intelligence.

OEF and OIF demonstrated the importance of a theater ISR concept of operations, which requires a coherent collection strategy that fully integrates and optimizes all organic, multinational, allied, commercial, and national ISR assets.[7] Despite increased demands for ISR, operation centers have evolved or adapted little throughout the eight-year campaign. Current operations dominate Tactical Operation Centers (TOCs) with intelligence generally being a side

consideration. During conventional operations, this may be acceptable due to the relative predictability of forces, however, it is not acceptable during OCO where targets are tracked individually, and the allowed margin of error is small due to potential risk of collateral damage. Targets are developed with operations being conducted against the enemy at a time and place to maximize their operational impact. This can only be accomplished with an intelligence focused TOC. Operations, therefore become intelligence focused, with tracking and development of targets, and ISR becomes the priority of the TOC and operations staff.

Simply throwing technological ISR solutions does not increase effectiveness of conventional military HVI operations. Training for intelligence officers and collection managers must include not only employment of improved technologies but also how to anticipate the enemy and integrate collection planning, and intelligence analysis into operations. The human element of collection and intelligence analysis must be combined with the technical element in order to reap the full benefit of both.

Solutions

Providing BCT commanders with the ability to effectively execute HVI targeting requires a branched approach. The first branch requirement is technology. Improving RPV sensors with existing technology and developing new technology will give commanders advantages on the battlefield. The second branch is training intelligence personnel in how to most effectively employ ISR assets.

Technological Solutions

Target identification is the priority with sensors. Regardless of the category of the operation: POL, Overwatch or BA, the target must be accurately identified. During counterinsurgency operations, misidentification of a target often has significant negative consequences. The

discussion on sensors that follows, proposes some solutions to gaps in current ISR collection capability.

Color at Night

Issue: Current sensors cannot distinguish color at night.

Discussion: Infrared and thermal technology provide rapid location of potential targets but does not always facilitate positive identification of objectives. Most HVI interdictions occur during periods of limited visibility. As illustrated in the vignette, the color of the vehicle is what helped identify the target vehicle, but the vehicle was lost at night. In current operating environments curfews are emplaced which, when enforced, can curtail vehicle movement. However, curfews are not always enforced, particularly in rural areas where enemy personnel can continue to move at all hours. The ability to follow a vehicle and associated personnel continuously during periods of limited visibility is essential to developing an understanding of and targeting threat networks. The ability to see at night also aids in identification of potential IED locations by distinguishing between the spoil, the soil removed from a hole when digging, and the topsoil surrounding the hole.

The ability to distinguish color at night also assists in identification of friendly indigenous forces, which do not always wear prescribed identification. Indigenous forces frequently travel during periods of limited visibility, and the inability to identify them, can cause their actions to be perceived as threatening. Rapid identification of vehicles, uniforms, and equipment will help reduce blue on green fratricide incidents. Preventing these incidents will help build trust between friendly forces in an already difficult environment.

Recommendation – Civilian corporations, such as Tanebraex, are developing the technology of night vision optics with the ability to see color in as little as one-quarter lunar illumination.[8]

Color vision is gained by placing a mechanical filter in line with the IR optics. When illumination is too low, the device is turned off and the sensor returns to IR. Placing this type of sensor on an RPV would significantly improve collection capability by augmenting thermal and infrared optical sensors.

Determining the Dog That Does Not Bark

Issue: Most HVIs do not have an electronic signature, such as an FM radio, telephone, or computer, although many individuals around them will.

Discussion: As the targeting capabilities have improved in OCO, so has our adversaries understanding to counter these capabilities. As a result, senior HVIs typically do not personally utilize equipment with an electronic signature, making them harder to identify and locate. This often results in lower level members of a network being targeted in effort to capture the senior HVI. However, the trail to the HVI can run cold with the capture of the lower level individuals. Hyperspectral imaging (HSI) that may be manipulated across a frequency range, can map the electronic emissions from the object including personal devices. HSI would help identify individuals at meetings who are not carrying electronic equipment and, consequently, identifying HVIs. HVIs frequently travel in upscale vehicles. While these vehicles may not have communications equipment that lend them to rapid identification, the vehicles may have unique signatures based on engine function and microprocessors found in vehicles since the early 1980s.[9] These electronic signatures would help further identify vehicles used by targeted individuals. Given the current enemies' history of the utilization of subterranean facilities, hyperspectral imaging will help identify the location of these facilities and characterize the emissions to help determine which locations warrant further collection. Finally, hyperspectral imaging would assist in the identification and interdiction of IEDs, particularly radio controlled

IEDs. This would allow friendly units not only to neutralize the IED threat but also target the "trigger-man" for targeting and exploitation.

Recommendation – Develop a hyperspectral sensor for employment FMV RPV in order to help identify electronic emissions and provide positive visual correlation to the electronic emission for further exploitation and targeting.

Ground Moving Target Indicators (GMTI)/ Synthetic Aperture Radar (SAR)

Issue: GMTI provided by Joint Surveillance Target Attack Radar System (JSTARS) and Littoral Surveillance Radar System (LSRS) provide an electronic snapshot of the battlespace. The use of this data requires analysts to compare data collected by JSTARS and LSRS with previously collected data to determine its intelligence value.

Discussion: Detailed GMTI can provide wide area geographic development of targeted networks. Limited on-station time and difficulty in adjusting the on-station time of manned platforms, due to crew limitations, often results in GMTI not being available when needed. Long duration GMTI over targeted areas coupled with FMV of suspected locations can refine targeted areas and provide further intelligence for exploitation. POL data developed in this way could provide geographic network linkages for further targeting and exploitation. GMTI could also be used in high IED activity areas to track networks of emplacers, "trigger-men," and suppliers from event locations to link-up points. Patiently tracking low level individuals to link-up points is often instrumental in the initial development of lines of targeting to HVIs.

GMTI systems can also offer the additional capability of synthetic aperture radar (SAR). In contrast to GMTI, SAR can be used to penetrate lightly camouflaged or shallow buried objects. The longer wavelengths of the radar are able to penetrate foliage, light snow pack and thin dry

sand cover.[10] This capability can assist commanders with the ability further interrogate suspicious locations for caches or IEDs.

Recommendation – Develop a small GMTI/ SAR sensor packages for RPVs that can be used in conjunction with FMV sensors on the same platform. RPV with dual GMTI/ SAR and FMV capability will provide persistent coverage of HVIs and associated areas of interest. This collection would assist analysts in linking activities between locations giving long term POL and target association development. Additionally, this capability would fill the gap of initial intelligence development of wide areas of interest that FMV leaves.

Digitizing Personality

Issue – Positive identification of HVI from RPVs is subjective and reliant on sensor operators and HUMINT sources.

Discussion – Despite advances in EO sensors on RPVs, identifying targeted individuals depends upon initial identification by HUMINT sources, passed in close coordination to sensor operators. Once the identity of a target is confirmed, it is up to sensor operators to maintain visual contact with the target. Threats to HUMINT sources often preclude reconfirmation if the operator loses visual contact. It is often up to the sensor operators to reconfirm the identity of a target. This is a subjective process, dependent upon familiarity with the target. The ability to digitize distinguishing personality characteristics of the target, such as walk and common gestures, would help remove much of the subjectivity in target identification.

Recommendation – Emplace a software filter in-line with the EO/ IR feed that is able to digitize distinguishing personality characteristics, thus aiding the sensor operator in confirming the identity of and maintaining contact with targeted individuals.

Databasing

Issue: After 8 years of OCO there are no central databases to correlate personnel and locations across theaters of operation.

Discussion: Coalition forces rely heavily upon computers to process information into intelligence and track operations. Information is often saved in a variety of programs including Microsoft PowerPoint slides. While information may be immediately useful, long-term utility of it is often lost when one unit rotates in to relieve another. Establishing a common database with common data formats that are accessible to all coalition partners would increase the value and accessibility to information but also the long-term value and accessibility. Enemy networks frequently utilize the same locations. Databasing this information would provide sensor operators, PED cells, interrogators and intelligence analysts with familiarity of the target. Making these databases available across theaters would also aid in identifying transnational network linkages. These databases would aid in the efficiency of coalition force rotation, as the intelligence gained from one rotation would not be lost during the transition to another.

Recommendation – Establish OCO databases accessible to and populated by coalition partners. Link databases to RPV displays so that observers may immediately understand correlations between observed locations and past collections.

Improved Downlink to Ground Forces

Issue – Ground forces rely on voice transmission of ISR information once away from vehicles.

Discussion – Once ground forces move away from their vehicles, they are reliant upon voice transmission of ISR information. Sensor operators are often unable to rapidly transmit information collected to the ground force commander. The most difficult, and critical, part of this

information they relay is the location of a moving target. In the pursuit of a moving target, precious time may be lost in delivering target information.

Recommendation – Flexible readouts would allow ground force leaders to have access to ISR feeds. Feeds could provide individually tailored information to users while at the same time reducing clutter and information overload. Flexible readouts would enable users to wear screens on their non-firing arm for ease of access.

Platform Characteristics

Issue – The addition of sensors is essential to more effectively targeting HVIs. Improvements in the operational capabilities of RPVs will also increase sensor effectiveness. RPV modifications for stealth have focused on the reduction of radar cross section. While this is effective in a conventional conflict against a technologically advanced threat, in COIN and HVI targeting the technological threat is typically minimal. Conventional stealth technology is not as important in this type of targeting as the mitigation of audio and visual detection, particularly since RPVs are often used a relatively low altitudes.

Discussion – The enemy hides so well that it takes multiple intelligence disciplines to develop one target. SIGINT can locate targets, but may not be able to identify them. FMV can track targets but cannot identify them. HUMINT can provide intent but rarely current actionable intelligence.[11] Dual capable platforms will help increase the efficiency of ISR platforms. Linking sensors used to detect the electronic emission, such as those of telephones or other electronic devices, to FMV aids not only in target identification but also precludes the need for another platform. Dual sensor platforms decrease airspace clutter and noise. Noise may not be as serious a concern in the urban environment where ambient noise often covers the noise of the aircraft.

In a rural environment, however, aircraft noise, even at higher altitudes, may be audible. Current sensor capabilities utilized in targeting HVIs requires multiple RPVs fly at lower altitudes while tracking the target. In OCO the acoustic signature of a tactical RPV, rather than traditional stealth properties, has become critical.[12] Current work to reduce acoustic signatures of RPVs is focused on isolating engine and propeller noise to determine which is more significant. An interim solution may be increasing the number of blades of the propeller, which significantly reduces noise. Recent modeling has shown that increasing the number of blades from two to six slightly increases the efficiency of the system while decreasing acoustic signature by over twenty-five percent.[13] Another solution may be emplacing a hybrid engine that would reduce the acoustic signature of the engine. This hybrid would work similar to that of an automobile by running on battery power in rural areas for up to several hours before needing to employ its internal combustion engine. The additional weight of the batteries may require a reduction in the amount of fuel carried by the RPV. However, the efficiency of the hybrid would enable to RPV to maintain its current on-station time. The hybrid may also be used to provide additional power in the event that the platform needs to move more quickly between locations.

Recommendation – Make RPVs dual capable, FMV and another ISR payload, in order to increase effectiveness of the platforms. Decrease the acoustic of RPVs by increasing the number of blades on the propeller and modifying the engine to intermittently run on batteries.

Training Solutions

No discussion of ISR capabilities is complete without considering the collection planning processes. Despite the growth in ISR capabilities, training to employ ISR capabilities has not kept pace. The focus of ISR continues to be deploying more assets into theater and increasing their availability. In April 2008 Secretary of Defense Gates established an ISR Task Force in to

capitalize on ISR assets already deployed in theater and to move more assets into theater as quickly as possible.[14] The ISR Task Force focused on the number of platforms and subsequent discussion continue to stress numbers.

The idea of increasing the number of ISR assets is immediately appealing. Few commanders and intelligence officers would argue against increasing the number of collection platforms available for combat. However, these platforms are rarely used to their maximum capability because intelligence officers are often not prepared to employ them. Intelligence officer training has not kept pace with the increased in number of ISR platforms in theater. Training personnel is the more difficult process in improving ISR capability. The introduction of highly capable ISR platforms will never be maximized unless personnel employing the platforms are trained to do so. Training must be focused on integration in the joint targeting process of find, fix, track, target, engage, and assess (F2T2EA).[15] For the intelligence officer, this narrows to communicating two core areas of study; understanding the platform and understanding the enemy.

Capability

Understanding ISR platform capability is straightforward. However, most training for those not operating the platform focuses on capability of the sensors. Intelligence officers must have an in depth understanding of not only sensor capabilities and limitation, but also capabilities and limitations of the aircraft. Operational altitude, orbit type, endurance, speed, and communications method are key components of platform capabilities that intelligence officers must understand if they are to maximize sensor capabilities of the system.

There is an art to employing ISR systems in a combat environment. For instance, RPV pilots and payload operators know the ideal operating altitude of their system and typically operate it at that altitude. For example, the RPV and sensor may operate best at 4000' mean sea level (MSL). MSL is a universal altitude reference that compares altitude to a constant, average height of the sea. In theater, 4000' MSL may translate into 2500' above ground level (AGL), the height of the ground over which the RPV is flying. This difference of 1500' in altitude could be the difference between a target seeing and hearing the platform or a platform being undetected. It is incumbent on intelligence officers and collection managers to understand the operating environment and how it affects both the target and collection system. Adjustments to the collection plan due to limitations brought on by communications distance, blackout periods during FMV orbits in urban environments, and other platform limitations must be constantly made during a mission. A better understanding of ISR platform and sensor capabilities will lead to better employment of the system and better exploitation.

The Enemy

When conducting operations, "the enemy has a vote." This is particularly true when targeting HVIs. Targeted individuals often choose personal courses of action, with few indications beforehand of their decision. Intelligence officer must be able to anticipate a target's decisions and develop a collection plan to accommodate for these decisions. However, HVI targets do not provide many indicators. "An all source intelligence network must cue airborne ISR. When applied against the low-contrast enemy, sensors must have a narrow field of view requiring a starting point provided by other resources." [16]

An all source intelligence network, capable of effectively cueing ISR platforms and developing a predictive collection plan, is the result of training thinking and proactive intelligence officers to understand the enemy. Understanding the enemy must be more refined then mirror imaging analysis that often results from the current intelligence training. While this method may have been acceptable in conventional warfare against a western enemy, it is not sufficient for targeting HVIs. Critical thinking, not simply absorption of information but refining information to determine its meaning and gaps, must be the cornerstone for intelligence training at all levels.

Currently, United States Army Military Intelligence Officers receive approximately four hours of introduction to critical thinking with facets of training throughout the course. Part of their training includes support to COIN operations with intelligence based on precedence. While the study of historic operations and conditions help analysts develop a basis of understanding intelligence procedures, the study of history without a corresponding study in how to conduct analysis leaves a gap in the analysts' abilities. The result is the analyst attempts to make the intelligence fit a known case study rather than look at it creatively in order to find the root cause or the "why" of the situation. This leads to understanding the enemy's motives versus understanding their actions in a predictive manner.

Critical thinking should be ingrained in analysts as part of their training to the degree that it becomes reflexive.[17] Training should be conducted at the company grade (O-1 through O-3) level in order to introduce critical thinking to intelligence officers at the lowest level and across all services, so that it becomes the baseline to which all analysts refer. Time is a constant and with the demand to get more intelligence officers into the field as soon as possible, expanding training is something commanders are not likely to initially support. However, the long-term

benefits of expanding this training will outweigh short-term difficulties. In order to diminish the impact across the services, the critical thinking course would not be offered to all intelligence officers during initial training. The priority for the critical thinking course would be tactical intelligence officers since these officers once present at their units are least likely to be able to attend training due to deployments and operations training cycles.

The changing battlefield, particularly in Irregular Warfare, has placed junior officers in the position of producing intelligence of strategic importance often in conjunction with joint and interagency partners. Intelligence officers must have the ability to develop and articulate ideas and analysis with minimal experience and employ ISR assets typically employed by much senior officers. The proposed critical thinking course provides depth in critical thinking skills and training opportunities for their application. This training, conducted with joint service partners would help develop select intelligence officers for combat assignments. This course would be composed of iterative blocks of instruction introducing and reinforcing critical thinking and intelligence analysis. These blocks of instruction would then be followed by case studies in Irregular Warfare, such as Lebanon and Chechnya, which reinforce the skills and techniques that students have learned in a joint intelligence environment. The "jointness" of the course provides the additional benefit of providing junior officers with joint experience and practice communicating intelligence effectively across the services. See Appendix 2 for sample course program of instruction.

Conclusion

The continuation of OCO poses a significant challenge to the United States Military. Conventional military forces and special operations forces continue to operate in

counterinsurgency environments in established theaters while continuing to conduct limited, precision operations in new areas of operations. However, the expanding target set of OCO requires Special Operations Forces to conduct operations in established and new theaters. With limited SOF resources already stretched thin by current deployments and other requirements, conventional forces must be prepared to assume the mission of HVI targeting in established theaters.

Technology in the form of increased RPV sensor capabilities will play a significant role in providing this enhanced capability to conventional forces. Combining traditional FMV capabilities with improved technical collection capabilities will greatly aid in HVI targeting. However, improved technical capabilities are only a part of the solution. Intelligence officers must also be trained to fully exploit these capabilities as well as develop critical thinking skills in order to conduct more effective intelligence analysis.

No solution is a simple as it first seems. The ideas proposed in this paper may initially appear deceptively simple, but they are complex and difficult to implement. Every new sensor requires a system of support and exploitation that demands new training. Training takes time, which is a precious commodity for the military, particularly during combat operations. However, the development and training time are well spent. More collection platforms and analysts are not always better. The right collection sensors with well-trained, critically thinking analysts is the long term solution to HVI targeting by conventional forces in the current and future conflicts.

Notes

1. Odierno, *ISR Evolution in the Iraqi Theater*, p 54.
2. Flynn, *Employing ISR SOF Best Practices*, 58.
3. Colonel Martin Schweitzer, Commander 4th BCT, 82nd Airborne Division.
4. Predator RPV maximum speed is 117 knots while the MC-12 (with a crew of 4) has a maximum speed of 312 knots.

5. Hinrichs, *Unmanned Full-Motion video (FMV) in Irregular Warfare: Better Framing the Issues*, p 8.
6. Flynn, *Employing ISR SOF Best Practices*, 58.
7. JP 2-01, *Joint and National Intelligence Support to Military Operations*, I-6.
8. Tanabraex Corporation, "See Color at Night," http://camouflage.com/colornightvision.php .
9. General Motors, "The Dawn of the Vehicle Mocroprocessor," http://wiki.gmnext.com/wiki/index.php/The_Dawn_of_the_Vehicle_Microprocessor .
10. NASA, *AIRSAR, Airborne Synthetic Aperture Radar*, http://airsar.jpl.nasa.gov .
11. Flynn, *Employing ISR SOF Best Practices*, 57.
12. Robinson, "The Silent Treatment: Aeroacoustics Research on UAVs Could Lead to Stealthier Surveillance," http://www.gtresearchnews.gatech.edu/newsrelease/uav-acoustics.htm .
13. Miller, "Noise Analysis of UAV Propeller," http://www.dtic.mil/dticasd/sbir/sbir021/n096.pdf .
14. Schaeffer, *ISR Task Force: Lessons Learned.*
15. JP 3-60, Joint *Targeting*, I-4.
16. Flynn, *Employing ISR SOF Best Practices*, 57.
17. Moore, *Critical Thinking and Intelligence Analysis*, XI.

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Appendix 1

Remotely Piloted Vehicle Usage Questionnaire

1. How many hours of Unmanned Aircraft System (UAS) ISR did your unit have per week while deployed? (Please include organic up to theater level assets)

2. Approximately how many hours of excess or deficit UAS did you have?

3. How did you typically employ UAS?
   - Pattern of Life Analysis (persistent eyes on objective or individual target):
   - Overwatch (From convoy escort to actions on objective):
   - Battlefield Awareness (General situation awareness or untasked time):

4. What sensor capabilities would have improved your UAS collection? These should include existing sensors, improving existing capabilities (refined EO/ IR) or new capabilities (distinguishing color at night).

5. Would these sensor capabilities have been sufficient to make up for any UAS gaps you may have had?

6. Other than quantity or sensors, were than any other shortfalls with UAS? (noise, operating altitude, duration, etc…)

Responses:

Respondent 1 (JSOTF J2 in Iraq)

1. Approximately how many hours of Unmanned Aircraft System (UAS) ISR did your unit have per week while deployed? (Please include organic up to theater level assets)

Approximately 700 (theater wide collection)

2. Approximately how many hours of excess or deficit UAS did you have?

Deficit of approximately 300

3. How did you typically employ UAS?
• Pattern of Life Analysis (persistent eyes on objective or individual target):
75%

• Overwatch (From convoy escort to actions on objective):
25% actions on the objective

• Battlefield Awareness (General situation awareness or untasked time):
0%

4. What sensor capabilities would have improved your UAS collection? These should include existing sensors, improving existing capabilities (refined EO/ IR) or new capabilities (distinguishing color at night).

Better EO but it is also a function of bandwidth and downlink…a lot of resolution is lost just transmitting it back to the C2 node…without improving the comms piece, improvements in EO sensor will not be fully realized. GMTI on UAS.

5. Would these sensor capabilities have been sufficient to make up for any UAS gaps you may have had?
No…it still takes 3 sensors to effectively manhunt.

6. Other than quantity or sensors, were than any other shortfalls with UAS? (noise, operating altitude, duration, etc…)

Altitude directly effects collection capability in high density urban areas…
Noise in sparsely populated areas
Duration for UAS pretty good…need to be able to go to turbo mode though to rapidly shift platform to different AO.

Respondent 2 (ABCT S2, Iraq)

1. Approximately how many hours of Unmanned Aircraft System (UAS) ISR did your unit have per week while deployed? (Please include organic up to theater level assets)

On average we have received over 400 hrs a week of coverage. We never had a deficit in collection assets other than Constant Hawk. We are starting to feel the effects of less JSTARS coverage as a result of the focus shifting from OIF to OEF.

2. Approximately how many hours of excess or deficit UAS did you have?

None

3. How did you typically employ UAS?

We typically employed our UAS's in support of both patterns of life analysis, battle damage assessments, and surveillance of IDF, IED, and IRAM TAIs in order to better interdict the enemies ability to employ those weapons in the Panther OE..

4. What sensor capabilities would have improved your UAS collection? These should include existing sensors, improving existing capabilities (refined EO/ IR) or new capabilities (distinguishing color at night).

The existing sensor capabilities were very helpful in the attempt to identify possible emplaced IED's/EFP's, caches, patterns of life, and IDF locations based off of their signatures.

5. Would these sensor capabilities have been sufficient to make up for any UAS gaps you may have had?

Yes.

6. Other than quantity or sensors, were than any other shortfalls with UAS? (noise, operating altitude, duration, etc…)

For the shadow, noise is definitely a shortfall. For the most part, the UAS's did what they were requested to do. The difficult part is actually catching someone in the act of emplacing IED's/EFP's or rocket rails.

Respondent 3 (ABCT Executive Officer, Iraq)

1. Approximately how many hours of Unmanned Aircraft System (UAS) ISR did your unit have per week while deployed? (Please include organic up to theater level assets). As a BCT we typically receive approximately 60 hours of UAS ISR coverage per week.

2. Approximately how many hours of excess or deficit UAS did you have?

From our approximately 60 hours per week, we generally receive additional UAS hours IOT support Time Sensitive Targets Operations (TST) as well as for Troops in Contact (TIC), when we were unable to provide support with the current assets on-hand. Approximately 4-6 hours of excess or in addition to the requested ISR. MND-B has always made every attempt to accommodate our ISR request, which were all either based INTEL and/or historical SIGACT.

3. How did you typically employ UAS?

- Pattern of Life Analysis (persistent eyes on objective or individual target):
  In the past 7 months we have employed UAS to observe patterns of life analysis 4 different times, approximately 20 hours. Each times the asset was generally focused on a specific location or target based on HUMINT received from reliable vetted source reports and spot report

- Overwatch (From convoy escort to actions on objective):
  UAS ISR is used to support convoy escort, route clearance patrol operations, and cordon and search / clearance operations for an average 50 hours of the 60 hour per week.

- Battlefield Awareness (General situation awareness or untasked time):
  In the past 7 months we have employed UAS to gain general situation awareness; each hour is specifically tasked to scan.

4. What sensor capabilities would have improved your UAS collection? These should include existing sensors, improving existing capabilities (refined EO/ IR) or new capabilities (distinguishing color at night).

- Synthetic Aperture Radar (SAR) Imagery-Can identify possible IED and weapon cache signatures (disturbed earth) and also the ability to identify man-made objects beneath natural camouflage.
- Two/Three Color Multi-View (2CMV/3CMV) Imagery-Identify the arrival/departure of large items (cars/trucks/ structure/dirt/piles/garbage piles/dead animals).

5. Would these sensor capabilities have been sufficient to make up for any UAS gaps you may have had?

Having SAR would have increased our success with possibly discovering caches in rural areas of the OE as well as the passable emplacement of EFPs along MSR/ASR with the enemy TTP of concealment using foam and concrete. 2CMV/3CMV capabilities when scanning for VBIED threats vicinity of key infrastructure would assist in the detection of suspicious vehicles.

6. Other than quantity or sensors, were than any other shortfalls with UAS? (noise, operating altitude, duration, etc…)

Shadow – The Shadow is an excellent BCT level asset the gives the BCT the flexibility to use in any way the commander sees fit to deny, disrupt and detect potential threat against USF.

Aerostat / Raid – The sensors on the Aerostat / Raid systems are satisfactory. The biggest limitation is how weather impacts operational support, specifically the wind and visibility. Of the two, Visibility should be at the commanders discretion and the use of advisory to warn aircraft of the potential hazard. The downside is the enemy uses not only the weather to his advantage but the lack of our ability to see him during these periods that the asset is down. The asset up even when visibility is poor is still a great deterrent.

Respondent 4 (ABCT S3, Iraq)

1. Approximately how many hours of Unmanned Aircraft System (UAS) ISR did your unit have per week while deployed? (Please include organic up to theater level assets). We typically receive approximately 60 hours of UAS ISR coverage per week.

2. Approximately how many hours of excess or deficit UAS did you have? From our standard 60 hours per week, we generally see additional UAS hours to support TST, type operations at the same rate that Division pulls away UAS support to provide assets to another BCT. In essence, the excess and deficits balance each other out to around our standard 60 hours per week.

3. How did you typically employ UAS?

- Pattern of Life Analysis (persistent eyes on objective or individual target):
  Very infrequently – We generally focus on specific locations or targets if we receive reliable vetted source reports, spot reports, or tactical report.

- Overwatch (From convoy escort to actions on objective):
  Most often, our UAS ISR is used to support convoy escort, route clearance patrol operations, or cordon and search / clearance operations.

- Battlefield Awareness (General situation awareness or untasked time):
  Infrequently – We sometimes use the UAS to try to confirm reports of explosions, fires, or other incidents that ISF have reported but have not been confirmed by USF.

4. What sensor capabilities would have improved your UAS collection? These should include existing sensors, improving existing capabilities (refined EO/ IR) or new capabilities (distinguishing color at night).

- Fused day camera and IR/Thermal capabilities may offer faster confirmation of fires or explosions at night or during hours of limited visibility.
- Dual cameras / sensors per single aircraft / UAS would offer twice the coverage capability without increasing the flight hour requirements for pilots and maintenance of the crafts.

5. Would these sensor capabilities have been sufficient to make up for any UAS gaps you may have had?

Having UAS with two sensors per aircraft, especially within cities or built up areas would be especially helpful. The ability to provide coverage for a unit for both actions on the OBJ and simultaneously scanning for approaching threats to the cordon forces, all under one UAS, would be easy for BCT level ISR managers to handle, minimizes the amount of airspace deconfliction requirements for air controllers, and provides twice the coverage to the ground forces.

6. Other than quantity or sensors, were than any other shortfalls with UAS? (noise, operating altitude, duration, etc…)

Shadow – The Shadow continues to provide good "eyes" for operations. However, it is still too loud for use in more rural areas, especially on operations such as OPs or overwatch of an OBJ prior to offensive operations when noise discipline is critical to prevention of early warning of the enemy. The Shadow also has limited duration of flight / time on station when compared to other small UAS such as the Scan Eagle.

Aerostat / Raid – The sensors on the Aerostat / Raid systems are adequate. The biggest limitation is how weather impacts operational support. The requirement for the balloons to go down and moor far in advance of inclimate weather due to the amount of time it takes the system to conduct mooring procedures should be addressed. These systems could continue to provide ISR support longer if the process to store the sensors, retrieve the balloons, and moor was sped up. Pending inclimate weather and lightning 50 miles away (typically more than an hour before bad weather is expected in an area of operation) seem excessive when operations are ongoing and soldiers are on the ground relying on the sensors to provide intelligence collection and support. The altitude of the balloons is fine as they provide both adequate sensor support and a visual deterrent to enemy operations.

Respondent 5 (JSOTF J2, Iraq)

1. Approximately how many hours of Unmanned Aircraft System (UAS) ISR did your unit have per week while deployed? (Please include organic up to theater level assets)

Approximately 500 hours (theater wide collection)

2. Approximately how many hours of excess or deficit UAS did you have?

No excess....always a deficit (although hard to quantify the deficit). I would guess at least 24 hrs per day deficit.

3. How did you typically employ UAS?

- Pattern of Life Analysis (persistent eyes on objective or individual target):
  Primarily POL analysis.
- Overwatch (From convoy escort to actions on objective):
  Sometimes.
- Battlefield Awareness (General situation awareness or untasked time):
  Never or at least very rarely.

4. What sensor capabilities would have improved your UAS collection? These should include existing sensors, improving existing capabilities (refined EO/ IR) or new capabilities (distinguishing color at night).

higher/better definition FMV day and night /more dual-use UAS //better quality even after re-trans // better/more sensor-shooter down-link capability //

5. Would these sensor capabilities have been sufficient to make up for any UAS gaps you may have had? Probably not....other than multiple sensors on same platform.

6. Other than quantity or sensors, were than any other shortfalls with UAS? (noise, operating altitude, duration, etc…)
We need to have a better capability to database all the info collected by UAS and manned systems. Ideally, data/FMV that exists in Afg from 2005 should be available to units getting ready to deploy there today.

Appendix 2

Sample Curriculum based on 75th Ranger Regiment Critical Thinking Course

Day 1 Personality Assessment	**Day 2** Critical Thinking Into to Heuer	**Day 3** Critical Thinking Heuer and Analysis of Competing Hypotheses	**Day 4** Cross-Cultural Competencies	**Day 5** Cross-Cultural Competencies
Day 6 Current Operational Environment	**Day 7** Current/ Future Operational Environment	**Day 8** Case Study I	**Day 9** Case Study I	**Day 10** Case Study I Presentation and Review
Day 11 Critical Thinking - Logic of Failure	**Day 12** Critical Thinking Asking the Right Questions	**Day 13** Current Operational Environment – Ideology	**Day 14** Current/ Future Operational Environment – Ideology	**Day 15** Case Study II
Day 16 Case Study II	**Day 17** Case Study II Presentation and Review	**Day 18** Critical Thinking Blink and Predictably Irrational	**Day 19** Critical Thinking Review	Day 20 Current Strategic Environment
Day 21 Current/ Future Strategic Environment	**Day 22** Case Study III	**Day 23** Case Study III	**Day 24** Case Study III Presentation and Review	

This POI provides iterative instruction followed by case studies of Irregular Warfare, such as Lebanon and Chechnya, which provide opportunities for junior analysts to practice the skills and techniques that they have just learned in a joint intelligence environment. The personality assessment will help each student to understand how he best learns and how personalities may best work together. While this will not provide the years of experience that are necessary to conduct analysis, it will provide and imprint common analytic skills across the services that may be applied in Conventional and Irregular Warfare operations.